WE CLAIM:

1. A method of removing noise from a time-domain based CUBE of seismic data consisting of a plurality of Traces, the method comprising the steps:

transform each said Trace into the frequency-domain, for the purpose of creating a frequency-domain based CUBE of seismic data, wherein the seismic data elements of said frequency-domain based CUBE are complex-valued;

disassemble said frequency-domain based CUBE into a plurality of constant frequency slices, each of said constant frequency slices consisting of a plurality of seismic data elements; and

for each constant frequency slice of said plurality of constant frequency slices:

form one Matrix $A_{m \times n}$ from each said constant frequency slice using said plurality of seismic data elements as the complex-valued elements of said Matrix $A_{m \times n}$;

rank-reduce Matrix $A_{m \times n}$ to create a rank-reduced Matrix $B_{m \times n}$ that is representative of Matrix $A_{m \times n}$;

substitute Matrix $B_{m \times n}$ in place of Matrix $A_{m \times n}$, for the purpose of forming a proxy slice that is representative of said constant frequency slice;

assemble a proxy frequency-domain based cube using said proxy slice, for the purpose of accessing each proxy trace in a plurality of frequency ordered proxy traces that are representative of said plurality of Traces; and

inverse transform into the time-domain each proxy trace of said plurality of frequency ordered proxy traces, for the purpose of forming a noise-suppressed time-domain based proxy cube representative of said time-domain based CUBE of seismic data.

2. The method as claimed in claim 1 further comprising the step of correlating said noise-suppressed time-domain based proxy cube with at least one other noise-suppressed time-domain based proxy cube associated with a common seismic data set.

3. The method as claimed in claim 1 wherein said noise is random noise.

4. The method as claimed in claim 1 wherein each said Trace is transformed into the frequency-domain using a Discrete Fourier Transform.

5. The method as claimed in claim 1 wherein said time-domain based CUBE comprises a plurality of time-domain based grids.

6. The method as claimed in claim 1 wherein the step of rank-reducing said Matrix $A_{m \times n}$ is carried out by decomposition executed using Singular Value Decomposition comprising the steps:

> decompose said Matrix $A_{m \times n}$ in accordance with $A_{m \times n} = U \sum V^H$, where $\sum$ is an ordered diagonal matrix and U and V^H are unitary, for the purpose of ordering the elements of said $\sum$ from largest at a_{11}, a_{22}, a_{33}, decreasing to smallest at a_{mn}; and
>
> forming a Matrix $B_{m \times n}$ that is of rank K where K is less than the lesser of m or n, and in the ordered diagonal matrix $\sum$ all but the top K elements along the diagonal are zeroed by replacing with zero values all but the top K elements along the diagonal of $\sum$ to form $\sum'$, after which Matrix $A_{m \times n}$ is recomposed as: $B_{m \times n} = U \sum' V^H$, where $\sum'$ is the rank-reduced version of $\sum$ having only the top K elements remaining non-trivial.

7. The method as claimed in claim 1 wherein the step of rank-reducing Matrix $A_{m \times n}$ is carried out by decomposition and only partially executed using Lanczos bi-diagonalization, for the purpose of achieving a reasonable approximation to full decomposition.

8. The method as claimed in claim 1 wherein the step of rank-reducing Matrix $A_{m \times n}$ is carried out by decomposition executed using the L1 matrix norm.

9. The method as claimed in claim 6 wherein the top K elements may be weighted or otherwise adjusted or processed.

10. The method as claimed in claim 6 wherein the value of K is determined by first applying a plurality of values of K and plotting the difference between said Matrix A $_{m \times n}$ and said Matrix B $_{m \times n}$ for each value of K of said plurality of values of K, and then selecting as the value of K that for which the plot of said difference shows insignificant indications of genuine reflector signal, for the purpose of removing noise without distorting genuine reflector signal.

11. The method as claimed in claim 1 further comprising the step of first spatially dividing the planar surface of a section of seismic data into overlapping planar grids for the purpose of correlating seismic data relating to a specific reflector.

12. The method as claimed in claim 1 wherein said CUBE is formed using any of:

- a rectangle of traces extracted from a stacked 3-D volume. The trace grid being comprised of inline CMP bins in the row direction, and crossline CMP bins in the column direction;
- traces from an unstacked 2-D line. The grid is composed of common source traces in the row direction, and common receiver traces in the column direction;
- traces from an unstacked 3-D volume, where the traces are taken from a single shot line and receiver line. The trace grid being comprised of common source traces in the row direction, and common receiver traces in the column direction; or
- traces from common-offset or common-angle stacks for a sequence of CMPs. The trace grid being comprised of common-offset or -angle traces in the row direction, and CMP traces in the column direction.